Thursday, February 20, PM

OXIDE REDUCTION II

(Phys. Chem. Comm./EMD, PTD/ISS)

2:00 pm — **Georgian Ballroom B (Americana)**

Chairmen: R. K. Iyengar, Jones & Laughlin Steel Corp., Pittsburgh, Pa., 15230
W-K. Lu, Dept. of Metallurgy, McMaster University, Hamilton, Ontario, Canada

A Physico-Chemical Model for Reactions Between Particulate Solids: General Solutions: *Y. K. Rao,* Associate Professor of Mineral Engineering, Columbia University, New York, N. Y., and Y. K. Chuang, formerly with Max-Planck-Institut für Eisenforschung, Düsseldorf, West Germany, and presently Research Engineer, Armco Steel Corporation, Middletown, Ohio

Based on a three-stage physico-chemical model, general solutions have been obtained for the reduction of hematite by carbon particles involving CO_2 and CO gases as the reacting intermediates. The results cover a wide range of reaction processes with the diffusion-controlled and the reaction-controlled regimes as two extremes. A simple criterion for justifying the use of asymptotic solution was developed. The prospect of applying current results to other metal oxide systems and the possibility of a non-equilibrium oxide reduction were also examined.

A Physico-Chemical Model for Reactions Between Particulate Solids: The Reduction of Hematite by Carbon: *Y. K. Rao,* Associate Professor of Mineral Engineering, Henry Krumb School of Mines, Columbia University, New York, N. Y.

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$$k_1 = 10^{2.5} \exp(-34{,}200/RT) \text{ mol/atm. g. of c. sec.}$$

The magnitude of the catalytic rate-enhancement due to the iron product was precisely defined at various temperatures.

Structural Changes and Kinetics in the Gaseous Reduction of Hematite: *A. G. Matyas,* Noranda Research Centre, Pointe Claire, Quebec, Canada, and A. V. Bradshaw, Royal School of Mines, London, England

Gravimetric and porosimetry measurements have been carried out for the reduction of Carol Lake hematite pellets in CO-CO_2 atmospheres. At temperatures below 800°C, the reduction of each hematite crystal to magnetite occurred at a shrinking-core interface, and the reaction rate was controlled by an interfacial step. At higher temperatures the reaction mechanism became complicated by a marked anisotropy in the growth of magnetite. The structural changes accompanying the transformation to magnetite were found to have a considerable influence on the mechanism and rate of the subsequent reduction to wustite.

Solid Structural Changes During the Reduction of Iron Oxides: *M. W. Pepper,* Exxon Research and Engineering Co., Linden, New Jersey, K. Ki and W. O. Philbrook, Carnegie-Mellon University, Pittsburgh, Pa.

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Characterization of Metallized Iron Pellets Produced from Agglomerated Reactants: C. E. Seaton, *J. S. Foster* and G. W. Lower, Michigan Technological University, Houghton, Michigan

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